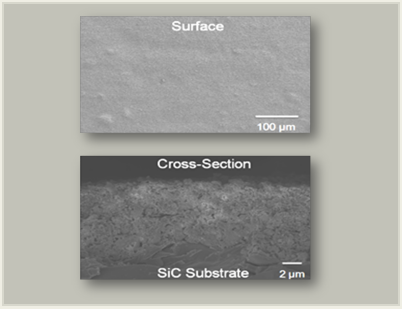
Polymer Derived Rare Earth Silicate Nanocomposite Protective Coatings for Nuclear Thermal Propulsion Systems, Phase I

Completed Technology Project (2013 - 2013)

Project Introduction

The objective of this Phase I SBIR program is to develop polymer derived rare earth silicate nanocomposite environmental barrier coatings (EBC) for providing next-generation corrosion resistance and thermal insulation to Aerojet's Nuclear Thermal Propulsion (NTP) systems. The NTP environmental barrier coatings will be developed from NanoSonic's innovate inorganic polymeric nanocomposite resins that crosslink to dimensionally stable gels under ambient conditions and gracefully transition to high temperature corrosion and thermally insulative resistant coatings at elevated temperatures. Through a synergism of nanoparticle – rare earth silicate load transfer pathways, NanoSonic's proposed EBC topcoat technology will readily absorb and dissipate high velocity impact threats while providing exceptional thermal shock resistance necessary for enhanced survivability of nickel-chromium based alloys within current and future NTP rocket engine rocket thrust chambers and nozzles. Working with team members Aerojet and the University of Washington, NanoSonic will molecularly engineer a family of rare earth silicate polymeric precursors that are specifically optimized for rocket engines within Aerojet's NTP space technology program. For the proposed effort, NanoSonic, the University of Washington and Aerojet have created an SBIR research team to rapidly identify, optimize and transition next-generation polymer derived rare earth silicate coatings specifically optimized to extend the operational utility of NTP rocket thrust chambers and nozzles. Within this teaming partnership, NanoSonic will continuously synthesize and optimize rare earth polymeric precursor coatings whereas the University of Washington will test coated nickel-chromium based alloys within flow conditions simulating NTP rocket exhaust. ANSYS thermal modeling will be employed to interpret and jointly optimize promising rare earth silicate coatings with Aerojet.



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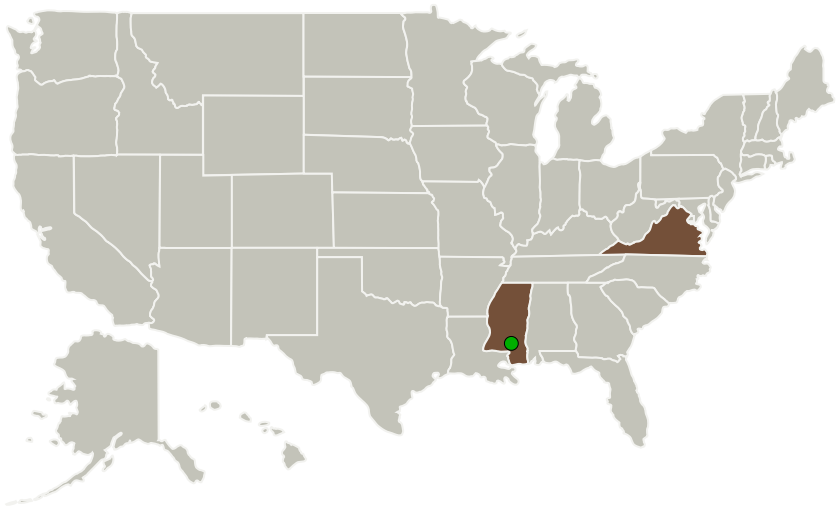
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Nanosonic, Inc.	Lead Organization	Industry	Pembroke, Virginia
Stennis Space Center(SSC)	Supporting Organization	NASA Center	Stennis Space Center, Mississippi

Primary U.S. Work Locations	
Mississippi	Virginia

Project Transitions

May 2013: Project Start

November 2013: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/140395)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Nanosonic, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

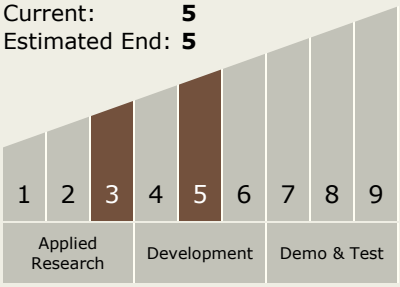
Carlos Torrez

Principal Investigator:

Victor V Baranauskas

Technology Maturity (TRL)

Start: **3**
Current: **5**
Estimated End: **5**



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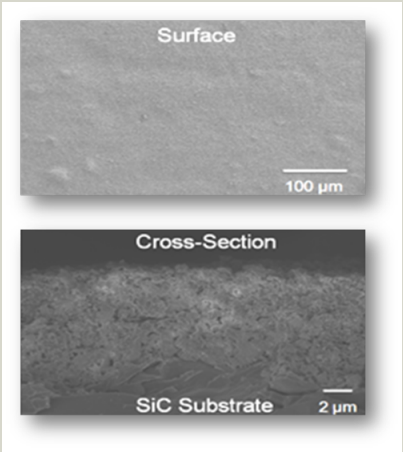
Images



Project Image
Polymer Derived Rare Earth Silicate Nanocomposite Protective Coatings for Nuclear Thermal Propulsion Systems
(https://techport.nasa.gov/image/132666)

Technology Areas

Primary:

- TX01 Propulsion Systems
  - TX01.2 Electric Space Propulsion
    - TX01.2.1 Integrated Systems and Ancillary Technologies

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System